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Mapping humanity: how modern genetics is changing criminal justice, personalized medicine, and our identities

by Joshua Z. Rappoport, Dallas, BenBella Books Inc., 2020, 300 pp., \$USD 17.95, ISBN 978-1-950665-08-2

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BOOK REVIEW

Mapping humanity: how modern genetics is changing criminal justice, personalized medicine, and our identities, by Joshua Z. Rappoport, Dallas, BenBella Books Inc., 2020, 300 pp., \$USD 17.95, ISBN 978-1-950665-08-2

Modern genomics have had numerous breakthroughs and progressions of their technologies being able to directly edit human DNA (Stein 2020), quantify inherited cancer risk via clinical genetic testing (Kensler *et al.* 2016), and prescribe personalized medicine treatments (also known as precision medicine) (Yang 2019). Yet what may lag behind with these technological and methodological advancements is a consideration of the philosophical and social implications these progressions also provide for not only the general public but often those involved in these genomic advancements (although the Ethical, Legal, and Social Implications (ELSI) of genetics scholarship most often address these considerations). It is evident that these advancements are not slowing down; in fact, genetic and genomic methods and utilizations in medicine, criminal justice, and direct-to-consumer testing areas are continuing to exponentially grow. Yet, some researchers argue the need for a 10,000-foot view of the broader field to understand how these advances will impact humanity and society as a whole. Joshua Z. Rappoport, in his recent book, *Mapping Humanity: How Modern Genetics is Changing Criminal Justice, Personalized Medicine, and Our Identities*, provides a substantial overview of the current genetics and genomic research and their potential impacts on humanity and society for a more general knowledge reader.

Rappoport lays his book out in five sections; going over the basics of the human genome, DNA sequencing methods, applications of genomic information, genetic engineering, and finally (implications) beyond the genome. He does this, he acknowledges, as a way to follow a linear series that builds upon previous chapters, while also developing the chapters as stand-alone pieces that readers could jump to as interest dictated. The majority of the book chapters are centered on the applications of genomic information, focusing on how DNA is used for ancestral testing, genetic screening, genomic justice, genome-wide association studies (GWAS), DNA and prenatal genetic testing, pharmacogenomics, personalized medicine, and gene therapy. It seems the reason Rappoport spends so much time on these applications is to lay the foundation for how these genetic technologies are being used now, their purposes, and their implications in their respective deliveries. The first two sections prior to these applications prime the reader to understand the basics of what genomic information analyses (e.g., DNA, RNA,

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gene expression, gene mutations/polymorphisms) and the older and modern-day methods scientists use to analyze these mechanisms (e.g., Polymerase Chain Reaction (PCR), the Sanger method, and next-generation sequencing).

As these are complex phenomena one aspect of the book, especially as a communication scholar, I really appreciated was Rappoport uses of personal anecdotes and analogies. Rappoport, as a trained biologist, clearly has an expertise in the scholarship of genetics, yet he writes in a way that does not lose the reader in the minutia of biological or genetic research and jargon. As a way to engage the reader, he pulls in examples of his own personal genetic testing using AncestryDNA report in the broader context of ancestral genetic testing. Rappoport mentions his Jewish identity and his family's beliefs of a long lineage of Jewish family ancestors. Fortunately, his AncestryDNA report confirmed this finding as reporting him as 98% European Jewish, yet he juxtaposes this finding with the question how can we define ourselves based upon questions of family, race and cultural findings with these ancestral genetic tests? Not only has this question been posed in personal heritage, but ancestral genetics have begun to be applied in social and political contexts, with Israel granting citizenship to individuals with 'proven' Jewish heritage via DNA analysis.

Rappoport, however, does not expand much more into these social and political contexts (circumstances relating to citizenship, national, and ethnic identity, etc.) beyond this example. His focus tends to be more on the various genetic technologies and their implications like genetic engineering (how GMOs will influence food production, genetic engineering uses for conservation and eradication, and the potential for CRISPR babies) to broader society and humanity. An expansion on these social and political contexts I believe is an interesting future area of study with the recent uses of ancestral genetic testing to prove biological superiority by White supremacists (Panofsky and Donovan 2019). While Rappoport briefly highlights genetic ancestry and race, he only dedicates 3 pages of the whole book on this topic, with his main conclusion being comparing genetic genealogy and our understanding of race and heritage is like, "comparing apples and oranges" (94). He goes on to citing historical uses of racial formation to create these racially distinct groups based on genealogical genetic differences. Bringing in the modern utilization of ancestral genetic testing by White supremacists, I believe would have been strengthened discussions on the social and political contexts that genetic information current exists within, as Rappoport could have highlighted the misinterpretations White supremacists use with analyzing their own genetic profile. Likely, as a biologist, Rappoport's goal was to provide more an overview from a biological perspective, not necessarily the ELSI perspective, which has written extensively on these genetic applications, yet this would have elevated the Rappoport's main assertion that using genetic genealogy to assert biological superiority as moot. In this sense, Rappoport perhaps is playing within his league rather than trying to play in another (to borrow his use of analogies).

Rappoport uses multiple analogies in his work to get readers to understand complex phenomena in a different way. To continue with the ancestral genetic testing example, he asks the reader to think about a group of people all part of a sports team. He notes that you know the height and weight of each team member, but you do not know the type of team the person belongs to. Yet you have reference data sets comprised of NBA basketball teams, MLB baseball teams, and NFL football teams, and could cross-reference the values from these various teams to the group of people previously mentioned above with no sport designation and give them a designation based on that data. Essentially this relates to single nucleotide polymorphisms (SNPs) arrays extracted from an individual's DNA to compare to a broader referent group (in DTC testing, it is all the previously tested individuals) and finding a recognizable pattern. However, a limitation that can arise is if one player from each team is too different from the referent data. This could mean if rugby or jai alai players are missing, you would be very challenging to correctly identify their origins. Rappoport here provides an example of himself with weight and height and demonstrates how complicated things can get when you add more variables of interest (body fat percentage, oxygen saturation, etc. with sports) (i.e. SNPs with genetic testing). This example, I believe provides the lay reader a solid conceptualization of genetic testing, yet may simplify the process to lose out on specific details (how the pattern is specifically found – GWAS studies, algorithms – which Rappoport does expand upon on later chapters). But, as the reader is meant to be more the general public, I believe the analogy is very well suited to explain the basic picture of ancestral genetic testing.

The last two sections of the book have Rappoport focusing on genetic engineering (via CRISPR) and other changes beyond the genome that has influence on genetic outcomes (epigenetics primarily). But it is Rappoport's case study on He Jiankui, a Chinese researcher that claimed to use CRISPR gene editing on human embryos that were subsequently born, that provides one of the strongest case studies. The edit in the genome, according to He, was to determine if one of the embryos could be HIV-immune compared to the non-HIV-immune twin. This clearly had ethical violations with He subsequently dismissed from his academic post and eventually jailed. Despite CRISPR ethics being widely written about for a number of years, He completed this experiment very recently in 2018 and perhaps opened Pandora's box of genetic engineering and manipulation. While there are many positive potential applications of genetic engineering (eradicating human diseases, improvement to food production, conversation, etc.), Rappoport notes that He's example should galvanize the genetics community to not only further study applications (and potential misapplications) of CRISPR in various contexts but to also be more cognizant of potential ethical issues as a priority.

Rappoport does spend a good amount of the book on how these current applications of genomic information are being used, but at times it seems he gets lost in explaining the technologies more than highlighting the potential impacts on

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humanity. Yet Rappoport ends the book by acknowledging the potential dark applications that can emerge as a result of these genetic technological and methodological advances and encourages that researchers cannot overlook these potential maladaptive uses. Rappoport states he has faith in the scientific methods and legal, regulatory, and ethical frameworks from these dismal imaginable outcomes. Rappoport takes an optimistic view and believes the future of genomics has infinite possibilities with proper and efficient applications of these technologies can benefit all. I agree with him, but think more should be explored in the context of social and political contexts of genomic information in the future and how to temper that within genetic advances. Overall, Rappoport's work proves useful by educating readers on how genetic information is processed, analyzed, and utilized in modern-day applications (ancestral and health genetic testing, food growth, GWAS, genetic engineering). But, Rappoport and other geneticists I believe have a responsibility to speak out more about the misapplications of genomic information (ancestral genetic testing used to assert White supremacy, genetic engineering, etc.) and should be the next step of future modern genetics scholarship.

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